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Western Division/Division de l'Ouest
2665 East Mall
Vancouver, B.C. V6T 1W5

Tel/Tél: (604) 224-3221
FAX/Télécopieur: (604) 222-5690

Eastern Division/Division de l'Est
319, rue Franquet
Sainte-Foy, Québec G1P 4R4

Tel/Tél: (418) 659-BOIS (2647)
FAX/Télécopieur: (418) 659-2922

1532

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Japan's Value Added Market: Wood Product Attributes and Competition

Attribute Analysis: Building Systems

by

D. Cohen
Associate Professor
Dept. of Wood Science
University of British Columbia

C. Gaston
Forest Products Market Economist
Wood Engineering Department
Forintek Canada Corp.

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Project Leader

Department Manager

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All errors or omissions remain the responsibility of the authors.

Executive Summary

General Results

- Approximately 225 Japanese consumers provided the information in this report. They are mostly in their late thirties or early forties and most expect to buy or build a house within the next five years. About three-quarters already own their own house.
- Approximately 170 small builders provided information for this report. They primarily construct single family detached houses and operate in one of the three large metropolitan areas of Japan (Tokyo, Nagoya and Osaka).
- Both consumers and builders are knowledgeable concerning formaldehyde emissions and both groups indicate a ***willingness to pay a small premium for products with lower emissions*** than current standards require.
- There is a strong indication that an independent quality assurance label will increase builders' and consumers' level of confidence when purchasing building systems. The country of origin is not relevant. Equal numbers prefer a process driven and a product driven program.
- The three reasons for replacing existing houses in order of importance are: 1) to change the style of the house, 2) the house is no longer sound due to decay and 3) the house is too small. ***It is very interesting to note that style is the most important reason for replacing a house.***
- Both consumers and builders strongly prefer wood houses (over concrete, steel pre-fabricated houses or don't care).
- Both groups prefer solid wood, even more than engineered wood products with steel and concrete relatively low on the preference scale.
- Over 60% of consumers expect to build houses that are larger than the average size for Japanese wood houses.

Results: Building Systems

- Post and beam is selected slightly more often than 2 by 4 by both builders and pre-cutters but the ratio indicates substantial room for additional growth in 2 by 4 market share
- Consumers and builders rank the types of houses in the same order with 2 story detached slightly preferred over 3 story detached. These are followed by connected row houses for builders and apartments for consumers. Connected row houses are selected almost 14% of the time by consumers and over 20% of the time by house builders.
- ***A hybrid house[1] shows surprising strength; selected most frequently by consumers and second most frequently (after post and beam) by builders***. This method of construction shows surprising strength for higher priced houses.
- There is interest in hybrid housing at all price ranges and price premiums were possible for a hybrid house.

[1] A hybrid house is defined as one using a mix of post and beam and 2 by 4.

- Much interest is shown for wood apartment buildings, indicating a growing market share for these types of apartments (where codes permit).
- Respondents select detached houses most frequently ***however a substantial minority (14%) select attached row houses*** (similar to town houses). This type of house is currently not available in Japan and indicates a real opportunity to introduce a new and lower priced building system. Land ownership patterns limit the potential for row housing.
- Strength and durability[2] are the most important attributes for both consumers and builders
  - Consumers also rank the following attributes as important in descending order: whether the house is detached, size, design and structural material.
  - Builders also rank the following attributes as important in descending order: method of construction, design, structural material, and green versus dry.
- While strength and durability are important for both groups, neither group is willing to pay a premium for these attributes. Consumers show faith in their current building code regarding strength.
- Builders consider post and beam houses the least durable and 2 by 4 and hybrid houses more durable. Each group shows interest in a more durable house.
- Even though durability is considered very important for consumers, longevity would not be enough to ensure convince consumers to select a certain house since the most important reason to replace a house is for design changes. Interiors must be designed for ease of remodeling including changing room structures and to facilitate additions (due to change in size and family structure to be housed).
- Builders consider houses built with European wood as most durable followed by Canadian wood (compared to Japanese and other imports).
- However both groups rank European wood least favourable overall. Japanese wood is the most preferred. Builders select Canadian wood more frequently than consumers do.
- There are significant sectors of each group selecting both high priced and low priced housing.
- ***The country of origin of wood for building systems is not at all important.***
- Builders select all forms of distribution sources for wood products, both local and national. There is willingness to source building materials from many sources of supply including local retailers. The larger the structure the more likely the supplier is a national firm.

[2] Durability was defined as how long the house would last, that is 20 years, 30 years, 40 years or 50 years. The reasons for replacement could have been both structural weakness, decay or cultural (e.g. style change required).

Opportunities for Building Systems

- There is a good opportunity to develop a quality assurance label based in Canada specifically for the Japanese market.
- There is a good opportunity for low formaldehyde building products, especially panels, which would sell for a slight premium.
- Focus on solid wood products that meet the strength and drying requirements of the Japanese consumer
  - ***Engineered wood products can be produced from low cost suppliers. The unique characteristics of BC wood is the solid wood where many low cost producers cannot compete with due to fast grown plantation wood.***
- Develop hybrid house design that predominantly uses BC building products. Brand naming, developing systems with trademarks (e.g. TJM Silent Floor System) are a few of the means to ensure use of BC building products.
  - Partner with Japanese house builder and use some Japanese products to ensure "the best regardless of country of origin".
  - Ensure interior house design can be changed with minimum cost and time to improve longevity of house.
  - Design house for multi-generational families (e.g. an in-law suite with small kitchen etc.).
- Explore possibilities of introducing row housing made from BC wood.
  - This will not have as much potential as the introduction of 2 by 4 housing but the adoption would be much quicker. It could cannibalize some existing sales of materials and may be restricted to low cost housing on a small land base.
  - Use what we have learned about building town houses in wet climates to produce row housing suitable for the high relative humidity and rainfall of the main island of Japan.

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1 Introduction

This report presents the results of personal interviews and surveys conducted in Japan from March 1998 to June 1998. Each of the six product groups are presented in separate reports starting with Wood Furniture followed by Outdoor Furnishings, Interior Finish, Wood Structural Members, Engineered Structural Products and Building Systems. This section summarizes the results for Building Systems. Table 1 shows which groups were surveyed for each product group.

Table 1: Product Groups and Interview Groups

Product Group	Types of People Interviewed
Building systems	Small builders & consumers
Engineered structural products	Small builders & pre-cutters
Wood structural members	Small builders & pre-cutters
Interior finish	Small builders & designers & consumers
Wood furniture	Consumers & designers
Outdoor furnishings & decking	Consumers

All reports follow the same format. First there is a summary of the general questions for the product category for each group interviewed. The survey questions are summarized with minimal commentary. Many of the questions will be clear from the text but to facilitate ease of use the questionnaire is shown in Appendix 1. Following this summary are the results of the conjoint (or trade-off) analysis for each group interviewed[3]. This includes both simple trade-offs and trade-offs between two variables. The third set of results is a brief summary of the market share analysis. This section briefly examines the implications of changing attributes on market share of different products. The last section summarizes the most meaningful results and identifies opportunities for BC producers.

Information regarding Building Systems was collected from two market segments: consumers and small house builders. Information was collected in Japan from April-June 1998 through direct interviews of 225 consumers and 170 builders located in one of the three major metropolitan areas (Tokyo, Osaka and Nagoya).

[3] For a full discussion of the methods used in this study please see the report titled "Introduction and Methodology for Wood Attribute Analysis.

2 Response to Questionnaire

2.1 Basic Consumer Respondent Demographics[4]

Of the 225 respondents 83% are male and 17% are female. Most are over 30 years old and the average age ranges from the late thirties to the early forties, the prime house buying age group in Japan. Almost all are high school graduates. Over a quarter have completed University and another 28.2% have completed 2 years of University.

2.2 Consumers and Housing[5]

In terms of who would make the house purchase decision, it is evenly split between a wife and a husband (50:50). Seventy-eight percent currently own a house and expect to upgrade within ten years and 22% do not own a house but expect to purchase on within the next ten years. Respondents expect to purchase a new house in 2.6 years on average. About half do not expect to purchase a new house within the next five years while a third expect to buy within the next 3-5 years. The remainder is planning on purchasing within the next two years.

The reasons for replacing their house are shown in Table 2. It is very interesting to note that less than 10% or respondents expecting to replace their house are doing so due to structural reasons and the most important reason is style followed by decay.

Table 2: Reasons for Replacing House

Reason	% of total indications
current house needs style	27.9
current house is no longer sound due to decay	21.7
current house too small	19.5
other	13.6
current house needs costly renovations	10.7
changes current house is no longer structurally sound	6.6
Total	**100**

[4] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

[5] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

Respondents were asked what type of house they preferred. Results are shown Table 3.

Table 3: Type of House Preferences

Type of House	% of 225 respondents
Wood 2 by 4	24.4
Wood post and beam	20.9
Mix of P & B and 2 by 4 (hybrid)	20.0
Steel or concrete	16.4
Don't care	10.2
Pre-fabricated	8.0

To help determine whether there would be an increase in houses for extended families the following question was asked " Who do you expect to live in you new house? " It is very interesting to note that 43% of respondents indicate that they expect their extended family (husband, wife, children and parents) to live in their new home once purchased or built. The remaining 57% expect the currently typical immediate family (husband, wife and children) to live in their new home.

Respondents expect to build a large house.

- 31 percent of respondents expect to build a house > 1,650 square feet (>50 tsubo or >165 m^2);
- 28% expect to build a house between 1,320 and 1,650 ft^2 (40-49 tsubo or 132-165 m^2);
- 26 % between 990 and 1,320 ft^2 (30-39 tsubo or > 99-132 m^2); and
- only 15% less than 990 ft^2 (30 tsubo or 99 m^2)

The house sizes indicated by respondents suggest that single family dwellings will continue to increase in size. This is maintaining a trend of the past two decades shown in Figure 1.

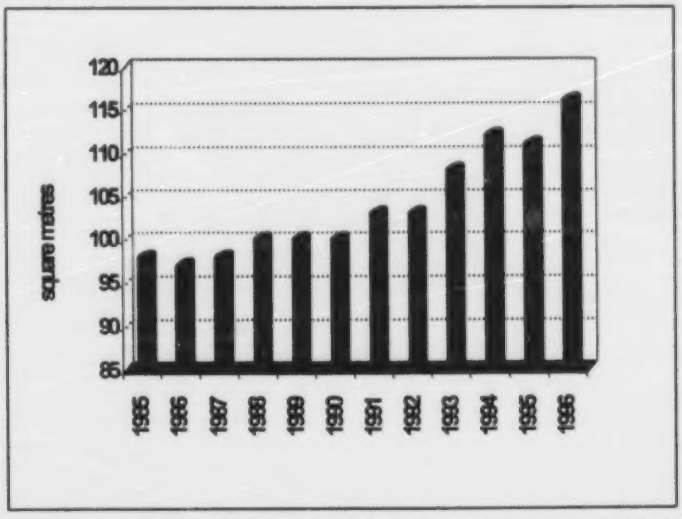

Figure 1: Average Wood House Size Constructed in Japan 1985-1996

2.3 Builders and House Construction[6]

2.1 Builders and House Construction[7]

The builders interviewed were the small house builders that are responsible for most of the wood house construction in Japan. Respondents were asked to identify the type and number of houses built in 1997. Table 4 shows the average number of houses per respondent by house type.

Table 4: Average Number of Houses Built by Construction Method

Type of House Construction	Avg. no. of houses/respondent
Post & Beam (traditional)	13.4
2 by 4	14.0
hybrid (mix of P&B and 2 by 4)	10.3
Prefabricated	23.2
Steel/Concrete	42.0

Results show that of the 3,720 houses built by respondents:

- ⇒ 56.4% are traditional post and beam,
- ⇒ 22.6% are 2 by 4,
- ⇒ 13.2% are hybrid houses (a mix of post and beam and 2 by 4 including mixes of concrete basements and wood stories),
- ⇒ 4.1% are steel or concrete and
- ⇒ 3.7% are prefabricated houses.

Builders were also asked how many and what type of house they expected to build three years from now in order to establish perceived trends. The cumulative results are shown below:

- ⇒ traditional post and beam is expected to decline to 49.4%,
- ⇒ 2 by 4 is expected to increase to 27.8%,
- ⇒ hybrid houses are also expected to increase to 15.3%,
- ⇒ steel and concrete are expected to increase to 5.5%,
- ⇒ prefabricated are expected to decrease to 1.9%.

[6] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

[7] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

In order to find out how builders would consider the use of panels in the most common types of wood construction they were asked to rate their preference for a variety of building systems. The addition of exterior panels, particularly to traditional post and beam construction is under consideration for increased strength and stability in earthquake zones. Figure 2 shows that while most small builders prefer to build as they always have (i.e. without the use of panels) there is not a great difference in preferences between using and not using panels. This suggest that as building codes in Japan adopt more and more performance based criteria and the traditional method must improve its earthquake performance panels could become the solution to increase stability for new houses in earthquake zones.

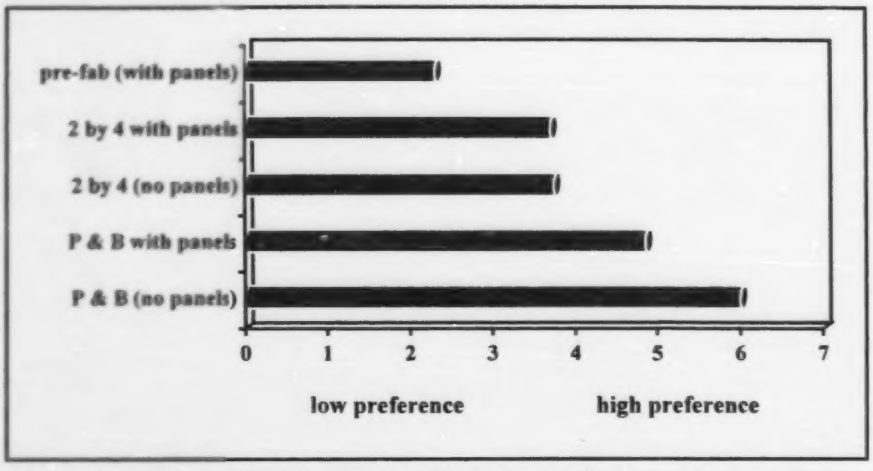

Figure 2: Preference for Construction Methods and the Use of Exterior Panels

There is a fairly even distribution of the size of house building firms represented with 19% building between 1-5 houses per year, 25% building between 6 and 10, 24% building 11-20 and 32% building over 20 houses annually.

2.4 Health Issues[8]

To gauge concerns over health issues several question were asked regarding formaldehyde emissions as well as willingness to pay for lower emissions.

2.4.1 Consumers and Health Issues

To gauge concerns over health issues several question were asked regarding formaldehyde emissions as well as willingness to pay for lower emissions. Two thirds of the respondents are aware of the growing concern over formaldehyde emissions in Japan. When asked if there was interest in a panel with 1/50th of the current emission standard almost three quarters of respondents indicated an interest. However the most interesting result is that 77% of all respondents are willing to pay a small premium for a panel with much lower formaldehyde emissions than current standards.

[8] Results are presented in six separate reports based on product groups, thus some information is repeated. Such repetition will always be footnoted.

2.4.2 Builders and Health Issues

Over 95% of all respondents indicate that they are aware of the growing concern over formaldehyde emission in Japan and are interested in a panel with 1/50th of the current emission standard. Slightly less than half (44%) are willing to pay a small premium for a panel with much lower formaldehyde emissions than current standards.

2.5 Quality Issues

Additional questions were included to assist the Wood Products Quality Council of Canada.[9] Results may be of interest to organizations not currently involved in this initiative. Information is first presented for consumers and then for the designers.

2.2.1 Consumers

It is clear that the consumer respondents react positively to quality assurance labels, particularly for houses and interior finishing items as shown in Table 5.

The most confidence placed in a quality label is from the country of purchase, that is a Japanese label (47% of respondents). Thirty two percent of consumers do not care where the label originated and 21% prefer a label from the country of manufacture. That is, half prefer a Japanese label and the other half either prefer a label from the country of manufacture or didn't care.

Table 5: Would an independent quality assurance label increase your level of confidence when purchasing:

Product	% that indicated an increase
Wood furniture	72
Building systems	83
Interior finish	80
Outdoor furnishings	56

Respondents consider testing wood products to some quality standard as important or extremely important. The average (on a 5 point scale with 1 = not at all important and 5 = extremely important) was 3.97. Almost all respondents indicate that this standard ranged from important (3) to extremely important (5).

Respondents are fairly evenly split when asked their preference between a quality assurance program that certifies quality in the **process** *(how well the product is manufactured)* or quality in the **product** *(how well the product fulfills its intended function)*. Slightly less than half (45.5%) prefer process while slightly more than half (54.5%) prefer product.

[9] The Wood Products Quality Council of Canada is an industry and FRBC supported organization committed to developing quality standards for the secondary wood sector of BC. It is being organized through the Centre of Advanced Wood Processing (CAWP) located at the University of British Columbia (UBC). Questions on quality were designed by Dr. Robert Kozak (CAWP, UBC)

Respondents were also asked to identify the relative importance of several factors in determining the quality of wood products. Results are shown in Table 6 with 1 = not at all important and 5 = extremely important. When reading the table, the higher the number the more important the factor.

Table 6: Relative Importance of Quality Factors

Factor	Relative importance
Product conformance *is product defect-free & meet known standards?*	4.53
Product serviceability *is the product easy to maintain and is service speedy and dependable?*	4.44
Product reliability *if used properly, will the product operate without failure over a specified time?*	4.40
Product performance *how does the product perform in its intended function?*	4.38
Product durability *how much can the product be used before it needs to be fixed or replaced?*	4.33
Product aesthetics *how does the product look, feel, etc. and is there a variety of styles?*	4.22
Product features*what types of features does the product have relative to the competition*	3.50
Perceived quality *does the manufacturer have a reputation or a recognizable brand name?*	3.30

It is interesting to note that product conforming to set quality standards is the highest preferred feature in determining the quality of wood products.

Builders were not asked questions concerning general quality issues or the importance of a quality assurance label.

2.6 Building Systems

2.6.1 Consumers

One hundred and twelve respondents answered questions concerning building systems. They were asked to rank the three most important attributes in a building system. Table 7 summarizes the results and calculates the score by assigning 3 points for a first place ranking, 2 points for a second place ranking, 1 point for a third place ranking and 0 points if the attribute is not ranked.

It is very interesting to note that the country of origin of material is of little importance to consumers. Their primary concerns are with performance characteristics (strength and durability) and design or comfort characteristics (detached, design, and size). While strength was the most important attribute it did not rank highly as the main reason for replacing existing houses (see Table 2).

Table 7: Most Important Attributes of House System for Consumers

Attribute	Score
strength (earthquake preparedness)	162
durability (how long the house will last)	130
whether the house is detached	98
house size	92
design (e.g. western, traditional Japanese, mixed)	73
structural material (wood, steel, or concrete)	68
method of construction (e.g. factory built, 2 by 4, post & beam)	41
country of origin of most building materials	5

Follow up interviews during the first two weeks of September, 1998 explored what Japanese builders and consumers meant by durability. Their definition changed based on the context. That is if they were referring to one situation they would define durability as rot resistance while in another situation they would refer to durability as strength. Readers are cautioned not to use to narrow a definition of durability when interpreting the results of this (and other) reports.

Respondents were also asked to indicate the relative importance of different structural materials. It is clear in Figure 3 that sold wood is most preferred, even compared to engineered wood products.

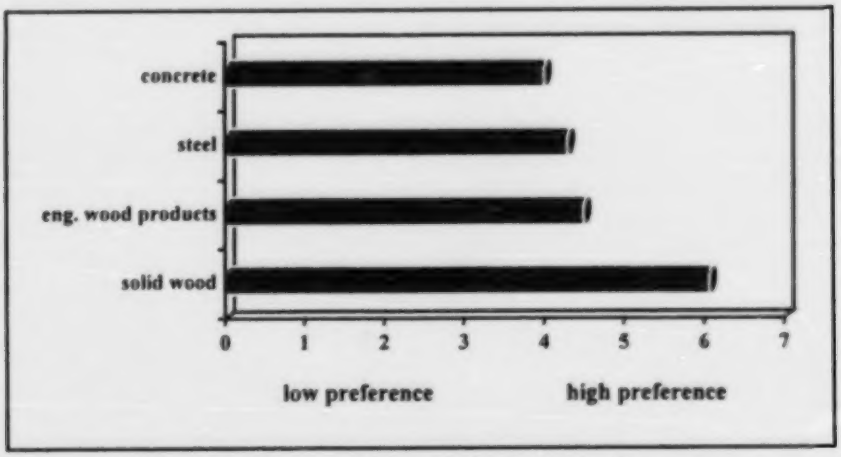

Figure 3: Structural Material Preferred by Consumers

Figure 3 shows respondents preferences for building method. P & B (no panels) is for traditional post and beam while P & B (panels) is for a post and beam house that uses sheathing panels for either the corners or for the entire house. The 2 by 4 (no panels) category is for the type of platform frame construction built in Japan where panels may only be used on the corners and 2 by 4 (panels) is for 2

by 4 with the use of full panel sheathing. Pre-fab represents buildings that are prefabricated in a factory and assembled on site. These houses are usually fully panelized.

It is very interesting to note that 2 by 4 construction has much less market share than consumer preferences deem to indicate. It suggests that over time 2 by 4 will continue to gain market share over post and beam.

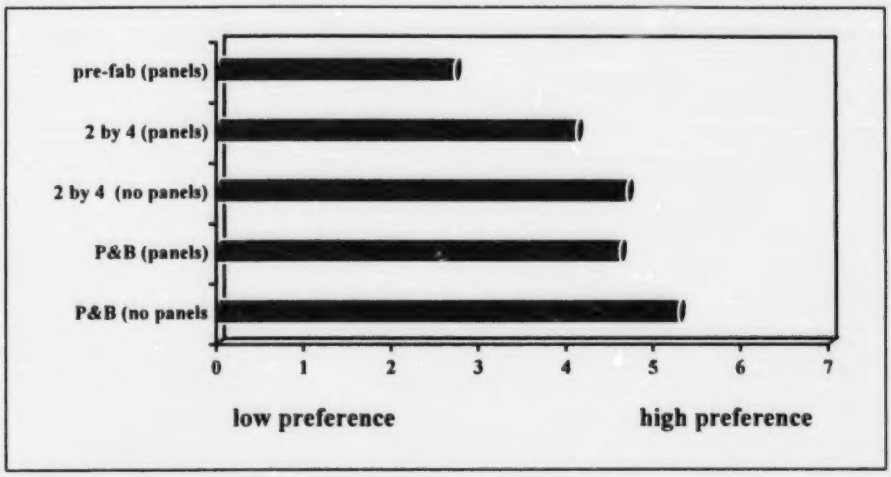

Figure 4: Construction Methods Preferred by Consumers

Result also indicate that although consumers prefer a post and beam house with not panels this preference is not that much higher than for a house which uses panels.

2.6.2 Builders and Building Systems

Eighty-four builders answered questions concerning building systems. They were asked to rank the five most important attributes in a building system. Table 8 summarizes the results and calculates the score by assigning 5 points for a first place ranking, 4 points for a second place ranking, 3 points for a third place ranking, 2 points for a fourth place ranking, 1 point for a fifth place ranking and 0 points if the attribute is not ranked.

Ease of treating and country of origin all had scores of less than 25. The low ranking for country of origin seems consistent regardless of product group or market segment.

It is interesting to note the importance of performance factors such as strength and durability. These are followed by design and construction method indicating that builders have a fairly firm commitment to the building method they are most familiar with and will be resistant to change. The issue of dry versus green building materials is fairly important with a score of 81 and a mid point ranking.

Table 8: Most Important Attributes of House System for Builders

Attribute	Score
durability (how long the house will last)	268
strength (earthquake preparedness)	265
method of construction (e.g. factory built, 2 by 4, P & B)	177
design (e.g. western, traditional Japanese, mixed)	162
structural material (wood, steel, or concrete)	122
green versus dry wood	103
house is detached	81
house size	37
size of structural members	26

Respondents were also asked to indicate the relative importance of different structural materials. From Figure 5 it is clear that sold wood is most preferred, even compared to engineered wood products. There is great similarity between material preference by both consumers and builders that wood is the most preferred structural material with engineered wood products a close second. It is clear that competition for BC structural wood products are from alternative suppliers of wood and engineered wood products and not substitute materials.

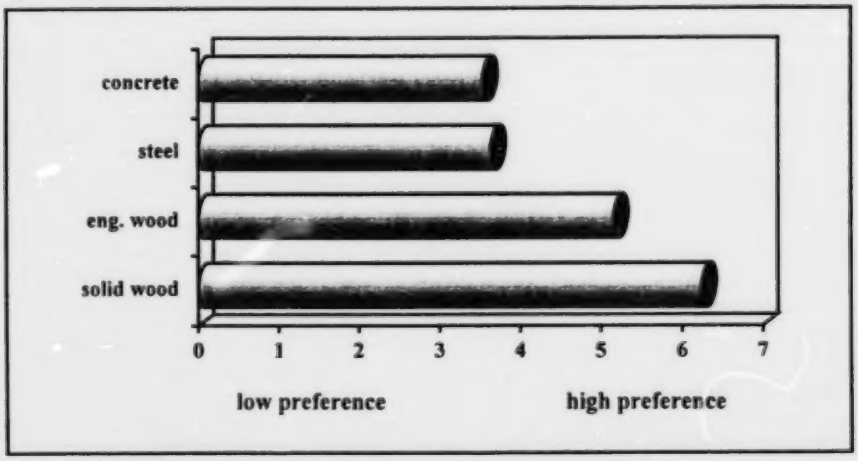

Figure 5: Structural Material Preferred by Builders

3 Trade-Off Analysis: Building Systems

For each product group designers and some consumers were asked to make choices between different types of products. Using trade-off analysis (or conjoint analysis) respondents are forced to trade off different attributes of a product. For example they would not be able to get all the best possible attributes at the lowest possible price but must make choices concerning how they will spend their limited resources. The methodology is complex and will not be discussed in this paper however an example of the type of choice they had to make is shown in Table 9. Each respondent had to make 20 such choices for building systems.

Table 9: Example of Choice Made for Building Systems

Please select one of the 4 choices shown below.			
1	2	3	4
♦ 2 story detached ♦ 5000,000¥ /tsubo ♦ wood from local retailer ♦ Japanese wood ♦ post and beam ♦ last 40 years	♦ 3 story detached ♦ 4000,000 ¥ /tsubo ♦ wood from local wholesaler ♦ Canadian wood ♦ hybrid ♦ last 20 years	♦ apartment ♦ 300,000 ¥ /tsubo ♦ wood from local retailer ♦ European wood ♦ 2 by 4 ♦ last 50 years	None of the choices are suitable

There are several types of results that will be reported. First will be the relative proportion of respondents that chose a certain level for a specific attribute. These simple trade-offs are discussed briefly. Second will be how respondents made trade-offs among different attributes. This helps determine if respondents are willing to pay a premium for certain attributes. The third type of analysis reported is in the market share section and involves "what if" analysis. For example how much market share would a certain product achieve assuming our respondents are representative of all consumers or designers. Product attributes and their levels were selected with input from industry and government personnel both in BC and Japan. The last section summarizes key results and apparent opportunities.

The results of these attribute analyses will feed into the international trade analysis to assess BC's relative competitiveness in a global market for specific product groups. They will also provide direction for determining which species in BC can be best used to meet Japanese customer requirements.

3.1 Consumers

For each product group customers were asked to make choices between different types of products. Using trade-off analysis (or conjoint analysis) respondents are forced to trade off different attributes of a product. For example they would not be able to get all the best possible attributes at the lowest possible price but must make choices concerning how they will spend their limited resources.

3.1.1 Simple Trade-Offs

Each respondent had to make a choice between 3 different types of building systems described by one level from each of the six attributes. They could also select none of the choices given. Respondents had to do this twenty times with different levels used for the same attributes. Levels and attributes were chosen with input from the project steering committee and additional input from BC representatives in Japan. They are shown in Table 10.

Table 10 shows the proportion of times a certain level within an attribute was selected. The statistical software used for conjoint analysis also completes statistical tests to ensure that differences are significant and not due to random chance.[10] Because there are over 2,000 choices made by over 125 consumers even a small difference can have meaning. The way this table can be read follows:

- 22.5% of the time consumers selected a price of 300,000 Yen per tsubo,
- 28.9% of the time consumers selected a price of 400,000 Yen per tsubo.

Because House Type is included in more than 2,000 selections the impact from the other attributes is minimized.

Table 10: Consumers' Relative Selection of Levels within Attributes for Building Systems

Attribute Level	% of time selected	Attribute *Level*	% of time selected
House type		**Construction Method**	
2 story detached	38.3	Post and Beam (traditional)	33.1
3 story detached	29.4	2 by 4	32.5
connected row house	13.9	hybrid (mix of P&B & 2 by 4)	34.4
apartment	18.3		
Price		**Durability**	
300,000 Yen/tsubo11	22.5	house will last 20 years	18.8
400,000 Yen/tsubo	28.9	house will last 30 years	22.7
500,000 Yen/tsubo	25.9	house will last 40 years	28.0
600,000 Yen/tsubo	22.7	house will last 50 years	30.5
Source of Wood		**Strength**	
Japanese wood	28.6	meets min. building code	21.0
Canadian wood	23.5	slightly stronger than min.	
European wood	23.3	building code (mbc)	24.6
imported (not Canadian or		stronger than mbc	26.3
EC)	24.6	much stronger than mbc	28.1

[10] Within each attribute there was a significant difference between levels tested using a Chi Square at $\mapsto$ = .01

[11] a tsubo is a traditional unit of measure for Japanese houses based on the tatami mat and is equivalent to 3.3 m^2 or 33 ft^2

House Type Over two thirds of the respondents prefer detached houses. The most interesting result is that *almost 14% selected row housing*[12]. This method of construction is not common in Japan and these results may indicate a potential niche market for Canadian design of town homes using BC wood products.

The vast majority of new single family house construction is replacement housing usually on a single lot. A large proportion of the remainder builds houses on single, vacant lots. The tendency to build on single lots combined with land ownership patterns in Japan limit the potential for row housing beyond niches in regions where new development can, and does, occur.

Price There is relatively even distribution of house prices. Substantial niches exist for both high end and low end housing with almost half selecting moderately priced housing.

Source of Wood While Japanese wood is slightly favoured, each of the four sources of wood are selected almost the same number of times. Remember that country of origin for materials ranked last in terms of importance of various attributes for building systems in the questionnaire. These results indicate little species preference among Japanese consumers other than a slight pereference for domestic wood.

Construction Method These results are surprising with traditional post and beam, 2 by 4 and hybrid being selected about a third of the time each. This indicates ***that 2 by 4 has room for substantial increases in market share*** given its existing level is less than 20% of current wood house construction. It also indicates a surprising interest in hybrid house construction that uses some construction techniques from both of the more traditional methods.

Durability[13] As the life span of the house increased, respondents selected that attribute more frequently. Houses lasting 50 years or more are favoured by almost a third of the respondents. This attribute is ranked second highest in the questionnaire. Durability is considered very important and it is expected that how the life span of a house will become more important in the Japanese market where current houses last less than 25 years on average.

However with design being the most important reason to replace a house (see Table 2), structural longevity and decay resistance will not be enough to increase the life span of a typical house in Japan. Interiors must be designed for ease of remodeling to facilitate changing room structures and adding additional rooms (due to change in size and family structure to be housed). In addition the realm of maintenance would need to be addressed. Time and space limit discussing this subject however house maintenance is rare in Japan.

Strength Almost 80% of respondents selected strength requirement that surpass the existing building code. While not surprising for a country which lived through the devastating Hanshin Earthquake, it does indicate ***some potential for building systems designed and promoted for their superior strength***. Strength also ranked as the most important product attribute in the questionnaire.

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[12] This selection was described in a complex manner in Japanese since row housing common in North America is not common in Japan.

[13] The authors found during interviews with large builders, pre-cutters, consumers and laminators in Japan during September, 1998 that the meaning of durability changed depending on how it was being used. At times those interviewed interpreted it as decay resistance, at other time it was strength, or lack of compression wood, or open design which would allow wheelchair access. It is the opinion of the authors that to the Japanese "durability" means longevity and the specific criteria required to achieve longevity change depending the context as does the definition of durability.

3.1.2 Two Way Trade-Offs: Consumers

Results also show how two different attributes interact with each other. People making purchasing decisions do not rely on a single product attribute in making their selection but rather on many attributes and how they interact with each other.

Only certain two-way trade offs are presented. Those interactions omitted are for the following reasons: 1) they provide little useful information, 2) there is little difference between different combinations or 3) statistical analysis indicated unreliable results. The results are summarized without presenting the tables or details of analysis for brevity.

Interaction of Price and Source of Wood (Country of Origin)

- Canadian wood is the least preferred for high end houses with Japanese wood the most preferred followed by anything else but Canadian wood.
- For lower priced houses (400,000 Yen per tsubo and less) Canadian wood is considered equal or better than alternatives except for Japanese wood which is usually preferred.
- Differences between species are not great and preferences are not felt strongly.
- Remember that species, equivalent to source of wood, ranked very low in the relative importance of different attributes in the questionnaire.

Interaction of Price and Building Method

- Opportunities exist for a higher priced house design using hybrid construction methods since consumers selecting higher priced houses preferred hybrid houses most frequently followed by traditional post and beam and lastly 2 by 4.
- There should be room for additional growth in 2 by 4 construction especially in the mid price ranges where it is almost equal to other construction methods.
- The surprise is the ***strong interest in hybrid house design for virtually every price range*** which indicates some distinct opportunities for both design, materials and house packages.

Interaction of Price and Durability

- There is a general trend among all price ranges to select more durable housing however it is important to note tradeoffs between durability and other attributes. The reader is cautioned against defining durability in a single way (see previous footnote).
- The results indicate a desire for more durable houses but not one that is much stronger than current code requires..
- An opportunity may exist to provide a longer lasting house for a premium but predominantly at the mid level price levels where the spread for durability is greatest.
- Despite the importance of durability (ranked second) there seems little evidence that consumers are willing to pay for this very important attribute.

Interaction between House Type and Source of Wood

- ***Consumers have little concern over where the wood is sourced*** regardless of the house type except for a slight general preference for Japanese wood.
- Opportunities may exist to capture market share from traditional users of Japanese wood due to consumers ambivalence towards source of material.

Interaction between House Type and Building Method

- Results indicate openness by consumers towards three story apartments built using wood.
- Given recent building code changes in Japan that allow three story wood apartments in quasi fire zones, ***opportunities exist for apartments as well as connected row housing*** all using wood.
- For detached and row houses, the hybrid house showed extremely strong acceptance by the consumers strongly supporting initiatives to develop both design and products for a mix of post and beam with 2 by 4.

Interaction between House Type and Strength

- Results are surprising since they do not indicate that there is much dissatisfaction with building codes and there ***is only a slight preference for increased strength.***
- It is only in apartments that there is any indication of substantial preference for stronger buildings than the code requires.
- Japanese consumers trust their building code despite the devastation of the Great Hanshin earthquake.
- Strength, the most important product attribute from the questionnaire did not retain its importance when it is bundled with other attributes[14].

The remaining interaction showed little results of substantial interest or was not statistically important.

3.2 Builders

Eighty-five builders answered the questions necessary for the trade off analysis.

3.2.1 Simple Trade-Offs: Builders

Results for simple trade-offs for builders concerning building systems are shown in Table 11.

House Type As expected two story detached and three story detached are the most selected house types. What is surprising is the strong showing of connected row housing. This is described in detail to differentiate from the older, lower quality connected housing built after the Second World War. In almost a quarter of the cases respondents selected connected row housing indicating that a substantial number of builders would be willing to try this relatively new concept in Japan. However as previously mentioned connected row housing requires lot sizes larger than is typical in Japan as well as a strong built for sale market[15].

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[14] This result is am example of the clarity this type of analysis brings. When considered independently strength is prime concern however it almost becomes unimportant when other factors are considered along with price. Many of the green product characteristics seem to have similar results. They are considered very important unless considered along with quality, price and availability criteria.

[15] Many of the houses built in Japan are replacement houses with those that are built by developers and placed on the open market (i.e. built for sale) represent only a small portion of total housing construction.

Table 11: Builders' Relative Selection of Levels within Attributes for Building Systems

Attribute Level	% of time selected	Attribute Level	% of time selected
House type		**Source of Wood**	
2 story detached	30.5	Japanese wood	28.7
3 story detached	27.2	Canadian wood	27.1
connected row house	22.0	European wood	20.9
apartment	20.3	imported (not Canadian or EC)	23.3
Price		**Construction Method**	
300,000 Yen/tsubo16	19.5	Post and Beam (traditional)	50.4
400,000 Yen/tsubo	30.5	2 by 4	18.2
500,000 Yen/tsubo	28.2	hybrid house (mix of P&B and 2 by 4)	31.4
600,000 Yen/tsubo	21.8		
Distribution		**Durability**	
local retailer	20.2	house will last 20 years	12.4
wood from local wholesaler	20.3	house will last 30 years	25.5
wood from local pre-cutter	21.1	house will last 40 years	29.7
wood from national supplier or trading house	17.7	house will last 50 years	32.4
wood from many different sources	20.8		

Price There is relatively even distribution of house prices. Substantial niches exist for both high end and low end housing with almost 60% selecting moderately priced housing (400,000 – 500,000 Yen per tsubo).

Distribution There is no statistical difference among the five choices for source of wood. This indicates either builders do not care where their wood supplies come from or there are sizable niches committed to each type of source for wood. What is surprising is the strong showing of retailers as a source for building supplies.

Source of Wood Japanese and Canadian woods are the most selected types of wood with European a close third. The percent that selected European wood is still less than their current market share indicating room for additional growth at the expense of Canadian wood. The similarity of percentages indicates that switching between wood sources is most likely common.

Construction Method As expected there is strong support for traditional post and beam construction. The biggest surprise is the large proportion that selected a hybrid house that includes three-story construction with a concrete foundation.

Durability About two thirds of respondents selected a house that would last longer than the current average (40 or 50 years with a current average of about 24 years). This indicates a fairly strong preference for more durable housing however it requires further analysis to determine if a price premium is available for increased durability.

[16] A tsubo is a traditional unit of measure for Japanese houses based on the tatami mat and is equivalent to 3.3 m^2 or 33 ft^2

3.2.2 Two Way Trade-Offs: Builders

Results also show how two different attributes interact with each other. People making purchasing decisions do not rely on a single product attribute in making their selection but on many attributes and how they interact with each other.

Only certain two-way trade offs are presented. Those interactions omitted are for the following reasons: 1) they provide little useful information, 2) there is little difference between different combinations or 3) statistical analysis indicated unreliable results. The results are summarized without presenting the tables or details of analysis for brevity.

House Type and Distribution When small builders are constructing two story detached houses they select wood from local pre-utters most frequently, followed by a national supplier or trading house. A local wholesaler is selected least frequently. For three story detached houses there is little difference between distribution sources for wood materials. For connected row houses wood is preferred from many sources and for apartments the selection favoured local suppliers.

House Type and Construction Method Builders selected a hybrid house for a 2 story detached structure with 2 by 4 a close second choice. However for three stories detached the post and beam method is selected more frequently. These results suggest a unique opportunity in developing a 2 story detached hybrid house which uses BC woods exclusively. Linking the design, construction method and materials may create additional demand for BC construction materials in Japan.

House Price and Distribution Builders of higher priced houses (600,000 Yen / tsubo) selected materials from national suppliers much more frequently than other sources suggesting that trading houses or national distributors are the best route for higher prices construction materials[17]. The lower priced houses selected local wholesalers as their preferred source. Mid range houses are fairly evenly distributed among all sources.[18]

Price and Source of Wood Canadian and European wood are selected most frequently for mid priced house. Lower priced houses preferred European wood but only slightly. Higher priced houses preferred Japanese wood followed by European wood and Canadian wood. Canadian wood is never the preferred material for any price range.

Price and Type of Construction Builders selecting mid priced houses also tended to select the 2 by 4 method of construction while the higher priced houses selected post and beam followed by hybrid and lastly 2 by 4.

Distribution and Source of Wood It is interesting that there is little difference in the types of wood carried by different distribution sources. All builders selected all four types of wood from all five suppliers in roughly equal fashion. Most likely all sources carry all types of wood.

Source of Wood and Durability Builders linked durability, one of the most important product attributes, to source of wood. European wood is expected to go into houses that lasted the longest. Canadian wood, Japanese wood and lastly other imports followed it. Canadian wood ranked quiet well and stressing the durability of houses built from Canadian wood should be considered for promotional material, especially since there are houses still standing that are built in the early seventies.

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[17] Construction materials are the materials that make up the super structure of the house and do not include all building materials.

[18] For more detailed information on distribution in Japan see Jahraus, Michael T. and David H. Cohen, 1997. "An Examination of Japanese Distribution Systems for Imported Wood Products." Working Paper 97.01 Canadian Forest Service, Pacific Forestry Centre. Victoria. 91 pages.

Type of Construction and Durability Post and beam houses are considered to have the shortest life span with builders decreasing their selection of this building method as the longevity of the house increased. The exact opposite is true for both 2 by 4 and hybrid houses that are selected more frequently as durability increased.

4 Market Simulation

The software enables analysis of market share potential and changes for different products with various levels of attributes. This allows calculation of potential market share given different types of building systems. While not all possible combinations will be calculated or shown the potential for building systems will be explored by presenting several scenarios. For this analysis the results from builders and consumers are presented separately since not all attributes are the same.

4.1 Consumers and Building Systems

The first market share run for building systems was to determine a base line for different materials. Results are shown in Table 12.

Table 12: Consumers' Market Share for Building Systems using Canadian Wood

Post & Beam	2 by 4	hybrid	none of these
2 story detached	2 story detached	2 story detached	
400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	
Canadian wood	Canadian wood	Canadian wood	
last 20 years	last 20 years	last 20 years	
meets minimum strength codes	meets minimum strength codes	meets minimum strength codes	
24.0%	**23.4%**	**25.0%**	**27.6%**

If Canadian wood is used then consumers would purchase almost equal numbers of post and beam, two by four, and hybrid houses with about a quarter not selecting any of these types of houses. This indicates openness to hybrid housing and increased potential for growth in the two by four market. If price is increased for all housing types then those that would not purchase any of these types of houses increases to 30.3% with all housing types loosing a little market share. As durability increased, there was a small decrease in those that would not select any of these choices.

The next analysis examines different sources of wood and how that impacts market share for different types of construction. First examined are traditional post and beam systems. The durability is kept constant at 30 years. Results are shown in Table 13.

Table 13: Consumers' Market Share for Various Sources of Wood for Post & Beam Construction

Japanese wood	Canadian wood	EC Wood	Other imports	None of these
2 story detached	2 story detached	2 story detached	2 story detached	
400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	
last 30 years	last 30 years	last 30 years	last 30 years	
meets minimum strength code	meets minimum strength code	meets minimum strength code	meets minimum strength code	
20.9%	**16.2%**	**15.8%**	**17.1%**	**30.1%**

- Japanese wood would capture the largest market share (~21%) followed by other imports, Canadian wood and European wood with these three having similar market shares (~16-17%).
- If price increases to 500,000 ¥/tsubo then other imported wood captures substantial market share increasing to 22.4% taking market share from all other categories. The other imported category may include laminated lumber and posts, which would explain this market share shift.
- If the strength of the building increases then the share for none of these decreases by 5% with a relatively equal share among the different woods.
- If all parts of Table 13 remain constant and the share scenario is run for 2 by 4 housing the market share results are: Japanese – 20.7%, other imported – 16.9%, Canadian –16.1%, EC - 15.7, none of these – 30.6%.

4.2 Builders and Building Systems

The first market share run for building systems was to determine a base line for different materials. Results are shown in Table 14.

Table 14: Builders' Market Share for Building Systems using Canadian Wood

Post & Beam	2 by 4	hybrid	none of these
2 story detached	2 story detached	2 story detached	
400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	
from pre-cutter	from pre-cutter	from pre-cutter	
Canadian wood	Canadian wood	Canadian wood	
last 20 years	last 20 years	last 20 years	
26.9%	**9.1%**	**15.9%**	**48.1%**

If Canadian wood is used then almost half the builders would not select any type of house. When the distribution source is changed from a pre-cutter to any other distribution channel there is still over 45% who would not build the house. When the price of the house is increased or decreased there are still over 45% who would not build the house. When durability is increased the proportion of those selecting none decreased as durability increased. At a 50 year durability with many sources of supply post and beam achieved a market share of 39.3%, 2 by 4 13.2%, hybrid 23.2% and none shrank to 24.3%. These results indicate a significant proportion of small builders will NOT use Canadian wood regardless of price or type of house.

- Increasing durability seems to be the only way to sway those who currently avoid Canadian wood for house construction in Japan.

The next analysis examines different sources of wood and how that impacts market share for different types of construction. First examined are traditional post and beam systems. The durability is kept constant at 30 years. Results are shown in Table 15.

Table 15: Builders' Market Share for Various Sources of Wood for Post & Beam Construction

Japanese wood	Canadian wood	EC Wood	Other imports	None of these
2 story detached	2 story detached	2 story detached	2 story detached	
400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	
from many sources	from many sources	from many sources	from many sources	
last 30 years	last 30 years	last 30 years	last 30 years	
23.2%	**21.6%**	**15.5%**	**18.0%**	**21.6%**

- Both Canadian and Japanese wood lead in market share for traditional post and beam construction with between 21.5 and 23.5% market share.
- As the house price increases there is little change except that a few more builders select none of the options. The same result occurs if the house type is changed to three story detached.
- For connected row houses, identified as a growth segment previously, the share for none increases and all other wood types decline. However over two thirds would still select a house if it were connected row housing. Because this is a new type of housing there seems to be no pre-disposition to any particular type of wood.
- When wood is purchased from local suppliers (retailers or wholesalers) the market share for European wood actually surpasses both Japanese and Canadian wood. This indicates limited distribution is holding back increased market share for European wood in Japan.
- When wood is sourced from a pre-cutter there is no difference in market share based on where the wood is comes from. However over a third of respondents selected none for post and beam construction if wood came from a pre-cutter.

Table 16 shows market share results for 2 by 4 construction.

Table 16: Market Share for Various Sources of Wood for 2 by 4 Construction

Japanese wood	Canadian wood	EC Wood	Other imports	None of these
2 story detached	2 story detached	2 story detached	2 story detached	
400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	400,000 ¥/tsubo	
from many sources	from many sources	from many sources	from many sources	
last 30 years	last 30 years	last 30 years	last 30 years	
16.3%	**15.2%**	**10.9%**	**12.6%**	**45.0%**

It is clear that some builders will build only post and beam and some will build only 2 by 4. There is also some that would build either or both.

- If the house is 2 by 4 builders are more open to materials from other than traditional sources with other imports surpassing European wood in terms of market share.
- If price increases there is little change in market share.
- There is little change whether the wood comes from local wholesalers or retailers or large national chains.

4.3 Further Market Share Analysis

Numerous scenarios are possible in market share analysis and not all possibilities are shown in this report. Should BC producers desire additional analysis please contact the authors.

5 Summary of Results

5.1 Summary of Key Results

- Approximately 225 Japanese consumers provided the information in this report. They are mostly in their late thirties or early forties and most expected to buy or build a house within the next five years. About three quarters already own their own house.
- Approximately 170 small builders provided information for this report. They primarily construct single family detached houses and operate in one of the three large metropolitan areas of Japan (Tokyo, Nagoya and Osaka).
- There is strong knowledge about formaldehyde emissions and respondents from both the builders and consumers indicate a willingness to pay a small premium for products that had much lower emissions than current standards required.
- There is a strong indication that an independent quality assurance label would increase builders' and consumers' level of confidence when purchasing wood products. The country of origin is not relevant. Equal numbers prefer a process driven and a product driven program.
- The three reasons for replacing existing houses in order or importance are: 1) to change the style of the house, 2) the house is no longer sound due to decay and 3) the house is too small. ***It is very interesting to note that style is the most important reason for replacing a house.***
- Both consumers and builders strongly prefer wood houses (over concrete, steel pre-fabricated houses or don't care).
- Post and beam is selected slightly more often than 2 by 4 by both groups but the ratio indicated substantial room for additional growth in 2 by 4 market share.
- Both consumers and builders prefer solid wood, only slightly more than engineered wood products with steel and concrete relatively low on the preference scale.
- Consumers and builders prefer 2 story detached only slightly over 3 story detached followed by connected row houses for builders and apartments for consumers. Connected row houses are selected almost 14% of the time by consumers and over 20% of the time by house builders.
- ***A hybrid house[19] shows surprising strength; selected most frequently by consumers and second most frequently (after post and beam) by builders.*** This method of construction shows surprising strength at the higher prices for houses.
- There is interest in hybrid housing at all price ranges and price premiums are possible for a hybrid house.
- Over 60% of consumers expect to build a house that is larger than current Japanese average.
- Much interest is shown for wood apartment buildings indicating a growing share for these types of apartments (where codes permit).

[19] a hybrid house was defined as one using a mix of post and beam and 2 by 4

- Strength and durability are the most important attributes for both consumers and builders.
  - Consumers also rank the following attributes as important in descending order; whether the house is detached, size, design and structural material.
  - Builders' also rank method of construction, design, structural material, and green versus dry as important attributes.
- Although strength and durability are very important builders and consumers are not willing to pay a premium for these attributes. Consumers show faith in their current building code regarding strength.
- Builders consider post and beam houses the least durable and 2 by 4 and hybrid houses more durable. Each group shows interest in a more durable house.
- Builders consider houses built with European wood as most durable followed by Canadian wood.
- Although consumers consider durability as very the most common reason for replacing a house is design. This suggests that longevity may have more to do with design than structural stability and durability over time. Interiors must be designed for ease of remodeling bot to change room structures and facilitate additions (due to change in size and family structure).
- European wood is ranked least favourable by both groups with Japanese wood the most preferred. Builders select Canadian wood more frequently than consumers did.
- Those builders that do not select Canadian wood would increase this selection if they felt that it was more durable.
- There are significant sectors of each group selecting both high priced and low priced housing.
- ***The country of origin is not at all important.***
- Builders select all forms of distribution sources for wood products, both local and national. There is willingness to source building materials from many sources of supply including local retailers. The larger the structure the more likely the supplier would be a national firm.
- If European wood was more available from local suppliers it would take additional market share from Canadian wood.

5.2 Opportunities

- There is a good opportunity to develop a quality assurance label based in Canada specifically for the Japanese market.
- There is a good opportunity for low formaldehyde building products, especially panels, which would sell for a slight premium.
- Focus on solid wood products that meet the strength and drying requirements of the Japanese consumer.
  - Engineered wood products can be produced from low cost suppliers and the unique characteristics of BC wood is the solid wood where many low cost producers cannot compete with due to fast grown plantation wood.

- Develop hybrid house design, which predominantly uses BC building products.
  - Partner with Japanese house builder and use some Japanese products to ensure "the best regardless of country of origin".
  - Ensure interior house design can be changed with minimum cost and time to improve longevity of house.
  - Design house for multi-generational families (e.g. an in-law suite with small kitchen etc.).
- Explore possibilities of introducing row housing made from BC wood.
  - This may have almost as much potential as the introduction of 2 by 4 housing but the adoption would be much quicker. The weakness of the house for sale market in Japan combined with the preponderance of single lot building sites would keep this market small. Row housing could cannibalize existing sales of some materials.
  - Use what we have hopefully have learned about building town houses in wet climates to produce row housing suitable for the high relative humidity and rainfall of the main island of Japan.

More opportunities will be developed once the competitor and linkage analysis is complete.

5.3 Research Opportunities

Research opportunities exist in the following areas:

- Design and engineering studies on connected row housing for Japan.
- Design and engineering studies on hybrid housing for Japan.
- Design and engineering studies on houses suitable for interior modification and ease of additions given the Japanese culture and building codes.

More research opportunities will be developed once the competitor and linkage analysis is complete.

Appendix 1: Building Systems Survey Questions for Consumers and Builders

General Questions to Consumers

sex female_____ male_____

age 20and over _____ 30 and over_____ 40 and over_____ 50 and over_____ 60 and over_____

education mandatory _____ high school graduate _____ university/college _____

graduate institute _____

income (000's) 300Y_____ 300 – 500Y_____ 500-700Y_____ 700-1000Y_____ 1000_____

Who will make the big purchase decisions?

wife_____ husband_____ not applicable_____

1. Do you currently own your own house?

   YES _____ NO _____

If NO please indicate when you plan to purchase a house and go to question 4 _____ years

2. When do you expect to replace your existing house?

   _____ within the next 12 months

   _____ the time period from 13-24 months

   _____ from 3 to 5 years from now

3. Why will you replace your house?

   _____ current house is no longer sound due to decay

   _____ current house is no longer structurally sound

   _____ current house too small

   _____ current house needs costly renovations

   _____ current house needs style changes

   _____ other (please specify) _____

4. Which type of house do you prefer?

   _____ wood post and beam (traditional)

   _____ wood 2 by 4 (platform frame)

   _____ hybrid (mix of post & beam and 2 by 4)

   _____ steel or concrete

   _____ pre-fabricated

   _____ do not care

5. Are you aware of the growing concern over formaldehyde emissions in Japanese homes?

YES _____ NO _____

6. Would you be interested in a panel with 1/50th of the formaldehyde emission levels of government standards?

YES _____ NO _____

7 Would you be prepared to pay a small premium for such a panel?

YES _____ NO _____

8. Who do you expect to live in you new house?

_____ your immediate family (husband, wife and children)

_____ your extended family (husband, wife, children and parents)

9. How big a house do you expect to build or purchase?

_____ < 30 tsubo

_____ 30-39 tsubo

_____ 40-49 tsubo

_____ 50 tsubo or larger

Questions for Consumers on Quality

[20]10. Would an independent quality assurance label increase your level of confidence when purchasing...

	YES	NO
wood furniture	❑	❑
building systems	❑	❑
interior finish	❑	❑
outdoor furnishings	❑	❑

11. Would you feel more confident with a quality assurance label from... *(check one)*

... the country of manufacture ❑

... the country of purchase ❑

... does not matter ❑

12. When purchasing wood products, how important is it to you to know that the product has been tested to meet some recognized standard? *(circle one)*

not at all important 1 2 3 4 5 extremely important

13. Given the choice, would you prefer to see a quality assurance program certify... *(check one)*

... quality in the process *(how well the product is manufactured)* ❑

OR

... quality in the product *(how well the product fulfills its intended function)* ❑

[20] Numbering does not follow logically since surveys were completed by user group and not by product group. However numbering system was retained to facilitate cross referencing the data base of information.

14. How important are the following factors in determining the quality of wood products you purchase?
(circle one for each factor, with 1 being not at all important and 5 being extremely important)

product performance *how does the product perform in its intended function?*	**1 2 3 4 5**
product features *what types of features does the product have relative to the competition?*	1 2 3 4 5
product reliability *if used properly, will the product operate without failure over a specified time?*	**1 2 3 4 5**
product conformance *is the product defect-free and does it meet with known standards?*	1 2 3 4 5
product durability *how much can the product be used before it needs to be fixed or replaced?*	**1 2 3 4 5**
Product serviceability *is the product easy to maintain and is service speedy and dependable?*	1 2 3 4 5
product aesthetics *how does the product look, feel, etc. and is there a variety of styles?*	**1 2 3 4 5**
perceived quality *does the manufacturer have a reputation or a recognizable brand name?*	1 2 3 4 5

Questions for Consumers on Building Systems

15. Please rank the three most important of the following product attributes for a house with number 1 being the most important.

_____ house size
_____ house is detached
_____ method of construction (e.g. factory built, 2 by 4, post and beam)
_____ country of origin of most building materials
_____ durability (how long the house will last)
_____ strength (earthquake preparedness)
_____ design (e.g. western, traditional Japanese, mixed)
_____ structural material (wood, steel, or concrete)

16. Please indicate the relative preference for the structural material of your preferred house.

	Low preference						High preference
solid wood	1	2	3	4	5	6	7
engineered wood	1	2	3	4	5	6	7
steel	1	2	3	4	5	6	7
concrete	1	2	3	4	5	6	7

- here: engineered wood means: factory made, wooden structural material, such as laminated wood, "shuseisai, and I –beam

17. Which type of construction method would you prefer?

	Low preference						High preference
traditional	1	2	3	4	5	6	7
traditional (panel)	1	2	3	4	5	6	7
2X4	1	2	3	4	5	6	7
2X4 panel method	1	2	3	4	5	6	7
pre-fabricated	1	2	3	4	5	6	7

General Questions for Builders

1. Please indicate how many houses you build in a year?

   1-5 _____
   6-10 _____
   10-20 _____
   21 and over _____

2. Please indicate what type of houses you built in 1997.

Type of House	Number	% of total
traditional (Post and beam)	_____	_____
2 by 4 (platform frame)	_____	_____
hybrid (mix of post & beam and 2 by 4)	_____	_____
pre-fabricated	_____	_____
steel or concrete	_____	_____
		100%

3. Please indicate what type of houses you expect to build three years from now.

Type of House	Number	% of total
traditional (Post and beam)	_____	_____
2 by 4 (platform frame)	_____	_____
hybrid (mix of post & beam and 2 by 4)	_____	_____
pre-fabricated	_____	_____
steel or concrete	_____	_____
		100%

4. Which type of construction method would you prefer?

	Low preference						High preference
traditional	1	2	3	4	5	6	7
traditional (panel frame)	1	2	3	4	5	6	7
2X4	1	2	3	4	5	6	7
2X4 (panel method)	1	2	3	4	5	6	7
pre-fabricated	1	2	3	4	5	6	7

5. Are you aware of the growing concern over formaldehyde emissions in Japanese homes?

YES _____ NO _____

6. Would you be interested in a panel with 1/50th of the formaldehyde emission levels of government standards?

YES _____ NO _____

6. Would you be prepared to pay a small premium for such a panel?

YES _____ NO _____

Questions for Builders on Building Systems

7. Please rank the five most important of the following product attributes with number 1 being the most important.

_____ house size
_____ house is detached
_____ method of construction (e.g. factory built, 2 by 4, post and beam)
_____ country of origin of most building materials
_____ durability (how long the house will last)
_____ strength (earthquake preparedness)
_____ size
_____ design (e.g. western, traditional Japanese, mixed)
_____ structural material (wood, steel, or concrete)
_____ ease of treatability of building materials
_____ green vs. dry wood components

8. Please indicate the relative preference for the structural material of your preferred house.

	Low preference						High preference
solid wood	1	2	3	4	5	6	7
engineered wood	1	2	3	4	5	6	7
steel	1	2	3	4	5	6	7
concrete	1	2	3	4	5	6	7